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September 25, 1998

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By Hand Delivery

EX PARTE OR LATE FILED

SEP 25 1998

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Magalie Roman Salas, Secretary
Federal Communications Commission
1919 M Street, NW
Room 222
Washington, DC 20554

Re: In the Matter of Amendment of Rules and Policies Governing Pole Attachments, CS Docket No. 97-98

Dear Ms. Salas:

Pursuant to Section 1.1206 of the Commission Rules, please find enclosed for filing an original and one copy of the New England Electric System Companies' Memorandum summarizing its ex parte presentation to the Cable Services Bureau on September 23, 1998.

Sincerely,

C. Joël Van Over

cc: Paige Graening, Esq.

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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SEP 25 1998

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
AMENDMENT OF RULES AND POLICIES GOVERNING POLE ATTACHMENTS	)	CS Docket No. **97-98**

NOTICE OF EX PARTE PRESENTATION
BY THE NEW ENGLAND ELECTRIC SYSTEM COMPANIES

Pursuant to Section 1.1206 of the Commission's Rules, the New England Electric System (NEES) on behalf of its retail subsidiaries, by undersigned counsel, hereby submit this memorandum summarizing its oral presentation to the Cable Services Bureau staff, attaching hereto written materials provided in support of its presentation.[1] In addition to those materials attached hereto, NEES provided one copy of the following publications, in support of its presentation: (1) *National Electric Safety Code* (1997), (2) *National Electric Safety Code Handbook* (19--).

NEES' ex parte presentation focused upon the proper allocation of the costs of worker safety space on joint use poles. NEES supports a pole attachment rate formula that is more flexible. In particular, the 40-inch workers' safety space (or neutral space) now included within the definition of usable space and within the usable space presumption of 13.5 feet, should be deemed unusable, at least in certain circumstances.

[1]The following publications and documents are attached hereto: *(1)* Proposed Agenda (Attachment 1); *(2)* J.W. Rowe, P. Graening, *The Transformation of Electric Utilities*, American Enterprise Institute (1998) (Attachment 2); *(3)* NESC Update, Vol. 7, Number 1 (Allen L. Clapp, Editor) (Attachment 3).

1. When a communications attacher has the choice of attaching in either communications space or supply space, and elects to attach in communications space, it is just and reasonable to allocate a portion of the workers' safety space to that attacher.

It can not be disputed that all attaching parties must comply with the NESC and OSHA requirements. Although it is typically assumed that the NESC requires a 40-inch worker safety space between supply space and communications space and that communications facilities be attached within the communications space, this is not accurate. Rather, the NESC requires that ***all*** attachers working in supply space—whether communications or electrical utility attachers—must comply with supply space work rules. If a communications attacher meets the supply space work rules, communication facilities may be placed in supply space. Thus, the decision to attach communications facilities in a separate comminations space is not mandated by the NESC but is either required by the pole owner or elected by the communications attacher.

NEES noted that its retail subsidiaries each permit all attachers the option of attaching facilities to supply space or communications space, as those areas are defined by the *National Electric Safety Code*. NEES' retail subsidiaries have each adopted an express policy concerning how dielectric fiber optic facilities may be attached in supply space, and other communications facilities may also be attached in supply space upon request.[2]

The only threshold requirement imposed by NEES' retail subsidiaries for attaching communications facilities in supply space is the attacher's agreement to follow all applicable NESC and OSHA requirements concerning the installation, operation and maintenance of

[2]See www.nees.com, Massachusetts Electric home page for the referenced policy.

facilities in supply space, and actual compliance therewith. A communications attacher may therefore choose to place its facilities in either communications space or supply space.

When such a choice exists, full utilization of pole resource is encouraged. However, the FCC's current rate formula discourages full utilization of the pole resource by creating an economic incentive to attach only in communications space. This incentive should be removed in favor of an economically neutral approach. Where there is a choice between communications and supply space, the attacher may elect to attach in supply space, thereby incurring the cost of NESC and OSHA compliance, or the attacher may instead elect to pay an allocation for worker safety space from which the attacher benefits, thereby saving the costs of more stringent NESC and OSHA compliance.

In summary, while NEES retail companies continue to take the position that the cost of worker safety space should be allocated to communications attachers in every instance because it exists for their benefit, the strongest case for such an allocation occurs where communications attachers are given the option of attaching in supply space. In this instance, the current FCC rate formula provides an economic disincentive to full utilization of the pole resource, and under current conditions, where an increasing number of attachers seek access to pole space, this disincentive will (over time) increase the costs to all attachers because new, longer, stronger poles will be required, and closer pole spacing will be required to accommodate strained resources. At some point, the finite pole resource will be exhausted.

Thus, the FCC should remove current disincentives to efficient utilization of pole space, and permit market forces to encourage full utilization of the pole resource in a safe environment.

2. NEES also explained to Commission staff its justification for excluding the top five inches of the pole from the usable space calculation. The top five inches cannot be used for attachments because placing a bolt to secure an attachment in this area shortens pole life by inducing cracking and splintering of the pole top, which weakens the pole and jeopardizes attachments near the pole top, and potentially in other areas of the pole as well.

Using a pole top extender does not make the top five inches usable. Rather, using a pole top extender makes it possible to use fewer poles (poles spaced farther apart) because the line anchored to the pole extender is held out of the way of the two lines anchored to the top most cross-arm. Because of line movement and sag characteristics of the top three lines, this positioning permits poles to be farther apart. If a pole extender is not used, and all three lines are attached to the cross-arm, the closer proximity of all three lines will require more poles to reduce sag and line movement. Thus, excluding the top five inches of the pole top from usable space, even when a pole extender is used, results in a fair and reasonable rate to all attachers. All attachers benefit from this configuration which encourages efficient utilization of resources.

3. Finally, NEES pointed out that certain State commissions have taken the position that the cost of worker safety space should be allocated to all attachers on a joint use pole. E.g., Maine, Kentucky, Wisconsin. (Attachment 4). Illinois also held this view for many years, changing its position only after intense political pressure, as described in the concurring opinion of commissioner Kretschmer. Id. Both Commissioner Kretschmer and a dissenting commissioner in the Michigan pole attachment rate proceeding noted that excluding the cost of worker safety space from the rate formula results in utility rate payers subsidizing communications attachers. Id.

CERTIFICATE OF SERVICE

I, C. Joël Van Over, do hereby certify that on this 25th day of September 1998, I served by U.S. mail a copy of the foregoing Ex Parte Presentation of New England Electric System Companies on the following:

Elizabeth Beaty
Federal Communications commission
2033 M Street, N.W.
Suite 804-Q
Washington, DC 20554

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C. Joël Van Over

6107788.1

Conclusion

NEES' retail subsidiaries presented to the Cable Service Bureau policy and economic reasons supporting the allocation of the cost of worker safety space and the five-inch pole top space to all attaching parties.

Respectfully submitted,

New England Electric System Companies

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Its Attorneys

September 25, 1998

1

US OFFICE PRODUCTS

PROPOSED AGENDA

Background

- Discrete areas of a typical joint use pole
- NESC—defined "worker safety space"
- Worker safety space exists only on joint use poles.

Who benefits from Worker Safety Space?

- Benefits to Communication Companies.
  - Human Safety Factors
  - Less rigorous and less costly worker training
  - Less expensive equipment
- Benefits to Electric Companies
  - Distribution companies do not need worker safety space
  - Not required for electrical attachments
  - Not required to maintain their own minimum clearances above grade
- Other Related Issues
  - Exceptions to worker safety space
  - Non-wire attachments
  - Pole top pins eliminate need for additional poles (thus fewer license payments by cable companies)
  - Clearances, sag, tension on joint use poles

Economics

- Incentives to maximize safety
- Cable companies may pay to assure safety through expensive training and equipment or through worker safety space cost allocation
- Additional costs without worker safety space

Sept. 23, 1998

2

3

US OFFICE PRODUCTS

Development and Application of the National Electrical Safety Code and related standards

Allen Clapp's DANESC Update

Quarterly Newsletter for power, CATV and telephone utilities

Volume 7 Number 1

In This Issue

Do you want to be the one who is **IN CHARGE,** or the one who knows **WHAT'S GOING ON?**

DANESC UPDATE™

Clapp Research Incorporated

Publisher and Editor: Allen L. Clapp

Associate Editor: John B. Dagenhart

Subscription Manager: Cynthia L. Hodge

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The responses and interpretations of the editors on questions regarding the NESC are not official interpretations. Official interpretations requests on the NESC must be directed to IEEE. See NESC for IEEE address.

From the Editor

Well over half of the questions we have received from our power, telephone and CATV clients in recent months have dealt with joint-use power and communication overhead facilities.

Many were trying to find appropriate places to add a communication cable in the supply space. Usually they wanted to use all-dielectric self-supporting fiber-optic cable (ADSS), but sometimes they wanted to use all-dielectric fiber-optic cable on metallic messengers. Many others were trying to find ways to add more cables in the communication space.

Often the problems dealt with disagreements among the joint users about either where what should go or who should pay for what.

Answering these questions requires a complete look at safety, reliability and cost issues. As befits the importance of each of these issues, and the timeliness of these discussions, this special double issue is our largest issue to date.

Allen Clapp

Code Quiz

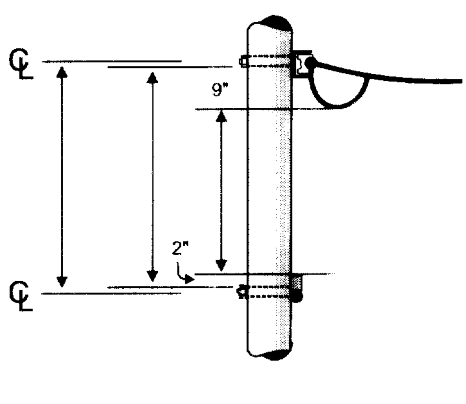
The Worker Safety Zone

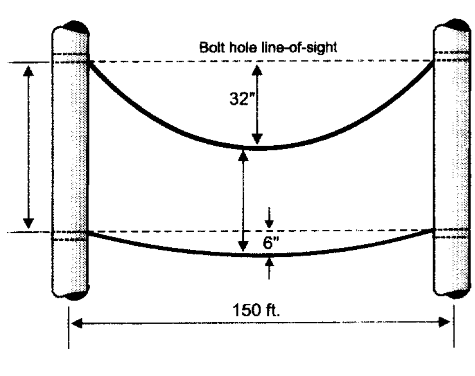
You are designing a new standard for attaching an all-dielectric, self-supporting fiber optic cable (ADSS) to be installed in the communication space below the level of the power secondary conductors.

The power company standards indicate that, for a 150 ft span and a 200 ft span, the maximum (ice loaded) sags of their 1/0 triplex secondary cable will be 32 in and 50 in, respectively. Connecting jumpers will not sag more than 9 in below the lower edge of the secondary bracket bolt hole.

Your ADSS cable has a minimum sag of 6 in for the 150-ft span and 8 in for the 200-ft span, under the conditions that produce the maximum triplex sag. Your bracket extends 2 in above the upper edge of the mounting bolt hole. You wish to have an extra midspan clearance of 0.25% of the span length, to allow for errors in stringing sags and tensions and pole movement.

What is the minimum worker safety zone clearance between the supply secondary mounting bolt and the communication mounting bolt for the two spans?





Joint-Use Pole Space Requirements and Cost Allocations

Joint use of overhead utility structures occurs when two or more utilities of the same or different types (*electric supply* [power] or *communication* [telephone or CATV]) support conductors or cables upon the same supporting structure. It is often less expensive for multiple utilities to share supporting structures than to build separate lines. Sharing structures, thus, interferes less with use of the land by the ratepayers.

With the advent of the 1996 Telecommunications Act and the onset of intense competition in some areas, communication utilities that were previously *placing new cables underground to achieve long-term benefits* are going back to *placing new cables overhead on existing poles to achieve first-cost benefits*.

Needless to say, sacrificing long-term benefit for short term benefit is not the best long-term strategy, but it seems we will be stuck with it until reason prevails.

In the past, typical joint-use poles consisted of a supply space for one electric power utility and a communication space for one telephone utility and one CATV utility. Now that the 1996 Telecommunications Act has essentially mandated letting anyone who wants access to a pole on it (if it is safe to do so), life is turning into a nightmare for pole owners.

One electric utility serving a large metropolitan area routinely has two telephone utilities and three CATV utilities on its poles in large areas of its system. That utility now has applications for attachments from five *alternative communication providers* (ACP), with three other ACPs wanting to talk about attachments.

Such activities have lead to significant disagreements among the parties as to the most equitable and practical method of allocating the total costs of joint-use poles to the appropriate utilities. These total costs include make-ready work, space, strength, reduced reliability, lower expected pole life, increased liability, etc.

Under NESC Rule 012B, it is the responsibility of the utility or contractor entity doing the work to assure that the NESC requirements are met. Thus, when a utility adds a cable or conductor to its own pole or one owned by another, it is the responsibility of the installing utility (or contractor) to assure that clearances, grounding, and strength requirements will be met.

Main Issues in allocating space

The main issues to be addressed are (1) qualifications (and costs) of workers, (2) required clearances between facilities (and, thus, extra pole length) and (3) required strength of structures (and, thus, greater pole strength classes).

The requirements and limitations applicable to each of these issues are contained in the National Electrical Safety Code (NESC), which is the American National Standard (ANSI C2) for design, construction, operation and maintenance of both public and private power, telephone, CATV, and railroad signal utility systems.

National Electrical Safety Code Requirements

The National Electrical Safety Code was originally started in 1913 by the National Bureau of Standards at the request of the U. S. Congress. The NESC Committee is accredited by the American National Standards Institute as having a balance of the interests involved. NESC procedures are approved by ANSI.

Originally, the Parts of the NESC were individually revised every decade or so. Since the Institute of Electrical and Electronics Engineers has taken over from the National Bureau of Standards as the Secretariat of the NESC, the NESC has been revised on a scheduled basis (originally 3 years; now 5 years).

NESC revisions are submitted, reviewed, and balloted in a very public process. Revision schedules are printed in each code book. Preprints of change proposals and subcommittee actions are made available for public comment. Consideration of comments occurs before the balloting process (another public process) begins.

Around the beginning of this century, joint-use of utility structures for the same utility type was accepted, but joint use of electric supply and communication facilities was discouraged in the NESC.

As the different industries learned how to safely coexist, various provisions were added to the NESC to facilitate safe joint use of overhead and underground structures. As a result of the good history with these provisions, consideration of joint-use facilities is now recommended by the NESC.

While there are many standards that cover specific practices or equipment used by the electric supply and communication utility industries, the NESC is the safety standard used by all, either directly or through utility standards developed therefrom.

The NESC is the only national standard containing the grounding, clearances and strength standards applicable to electric supply and communication utility installations.

NESC and OSHA Work Rules

The NESC construction rules (Parts 1, 2, and 3 of the code) recognize the needs of the worker in their grounding, clearances, and strengths requirements.

The work rules of Part 4 of the NESC are paralleled by OSHA requirements applicable to power and communication work. OSHA staff serve on the NESC Work Rules Subcommittee, and NESC work rules often precede adoption by OSHA.

Since the NESC is changed much more often than OSHA, the NESC is usually more current. Sometimes one will specify more detail in its requirements than specified by the other.

Use of the NESC

Although the NESC is a consensus document, it is used in some fashion in every state. Most states adopt the Code in its entirety by commission rule or statute. All states without direct adoption use the NESC in some fashion when the subjects covered by the Code arise.

The NESC is adopted by the Rural Utilities Services (formerly Rural Electrification Administration) of the U. S.

Department of Agriculture; RUS works with electric and telephone cooperative utilities. The NESC is likewise adopted by the American Public Power Association (the trade association of the municipal and public power utilities). Both of these groups serve on the NESC Committee.

The NESC has been adopted by the various armed forces of the United States and is used to design and operate utility systems in approximately 100 developing countries receiving help from U.S.A.I.D programs.

Portions of the NESC are presently under consideration for adoption in Europe. The NESC is considered the Safety Bible of the electric supply and communication utility industries.

Format of NESC Requirements

The National Electrical Safety Code is a performance standard. The NESC tells the utility industries what must occur, and leaves wide latitude for the utilities to use measures appropriate for the specific local conditions to meet its requirements.

It should be obvious from the following discussions that the NESC clearance values cannot be used as a design standard. Additional clearances must be installed to account for errors in sags and tensions, subsequent movement over the life of the installation, and other factors.

NESC Requirements and Practical Considerations

Part 2 of the NESC is the *Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines.*

Rule 222—*Joint Use of Structures* reads as follows.

> Joint use of structures *should be considered* for circuits along highways, roads, streets, and alleys. The choice between joint use of structures and separate lines *shall be determined* through cooperative consideration of all the factors involved, including the character of circuits, the total number and weight of conductors, tree conditions, number and location of branches and service drops, structure conflicts, availability of right-of-way, etc. Where such joint use is mutually agreed upon, it *shall be subject* to the appropriate grade of construction in Section 24 (emphasis added).

When reading the NESC, two key words affect use of the requirements: *shall* and *should*. If conditions are such that a *shall* rule applies, then the remedy specified by the Code must be done. If a *should* rule applies, the Code recognizes that the specified remedy is appropriate in the vast majority of cases, but that there are significant instances where something else will be more appropriate, usually because of simultaneous conditions.

By its careful choice of words, the NESC recognizes that, while joint use is often desirable, joint use is not appropriate in many locations. It also recognizes that, when joint use is being considered, issues involving qualification of workers, required clearances, and required strengths must be resolved.

> *The NESC tells the utility industries what must occur, and leaves wide latitude for the utilities to use measures appropriate for the specific local conditions to meet its requirements.*

Rule 220A promotes safety through standardization of the levels and locations of lines and equipment by agreement of the utilities involved. This makes it easier to identify the nature of the facilities and take the appropriate actions to work (or install provisions to allow others to work) around the facilities safely.

Electric supply conductors should be located above communication cables and conductors (Rule 220B). Communication workers are not allowed by either the OSHA regulations (29 CFR 1910.268) or the NESC work rules (Rule 432) to position themselves above the level of the lowest supply conductor on joint-use structures.

Communication workers must not come closer to supply facilities than the approach distances of NESC Rule 431 and Table 431-1. The values in OSHA Table R-2 of 29 CFR 1910.268(b)(7) are outdated and should not be used; they have not yet been increased to reflect new flashover data.

Electric supply and communication conductors and cables must be positioned so that, under expected ice and thermal loading conditions, they will not come too close together in midspan.

To accomplish these goals, Rules 235 and 238 specify clearances between these facilities at their attachment to joint-use structures. These rules give appropriate clearances between the closest facilities of each type by creating a *worker safety zone* between the lowest electric supply facility and the highest communication facility on the structure.

Special rules apply to the installation and maintenance of any communication cables that are to be located in the electric supply space, including use of the special work rules applicable to qualified electric supply workers. These will be discussed later.

Typical Joint-Use Installations

The following discussion centers around the historically normal installations on joint-use structures, where all communication utilities keep their cables in a designated communication space below the supply space.

On joint-use structures involving power and communication facilities, the two kinds of facilities are typically separated vertically.

The greater of two requirements must be met: (1) a basic clearance at the structure and (2) a midspan clearance.

NESC Clearance Requirements Between Items Located in the Electric Supply Space and Items Located in the Communication Space

Rule 235C specifies the vertical clearances (surface-to-surface dimensions, not center-to-center) between supply and communication conductors and cables. Rule 238B specifies vertical clearances if the closest item in either space is a bracket.

Rule 235C1 and Table 235-5 specify the basic clearances between the nearest conductors and cables at the structure. Column 1, Row 1 of Table 235-5 requires a 40-inch vertical clearance at the structure between the lowest supply conductor or cable (including jumpers) and the highest communication conductor or cable below.

Voltage adders apply if the supply conductor exceeds 8700 Volts-to-ground

The lowest supply item is often a jumper connecting a tap to the main line. Similarly, the highest communication item is often a jumper, particularly for some CATV installations. See Photo 1.

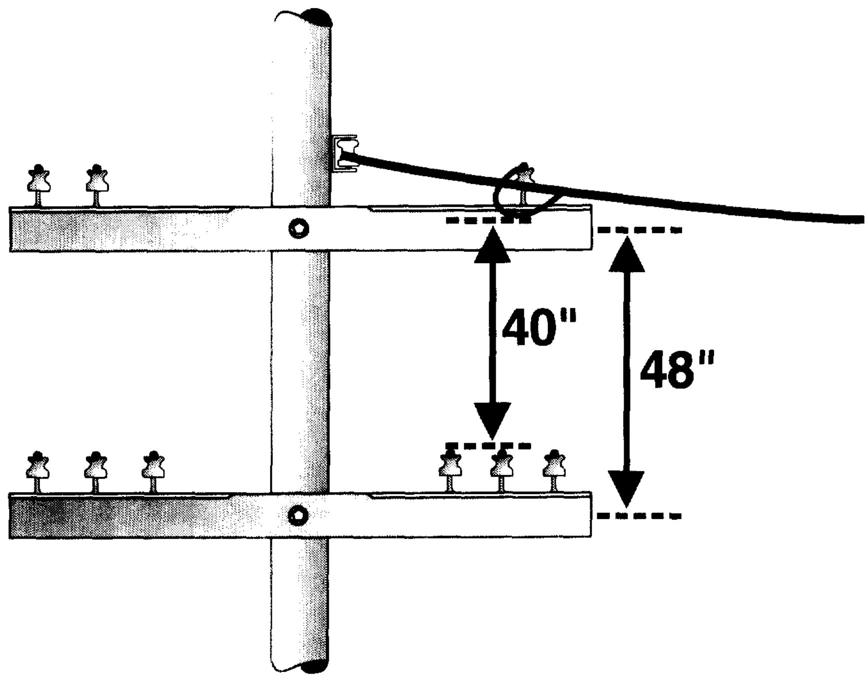


Figure 1 — Old NESC Requirements

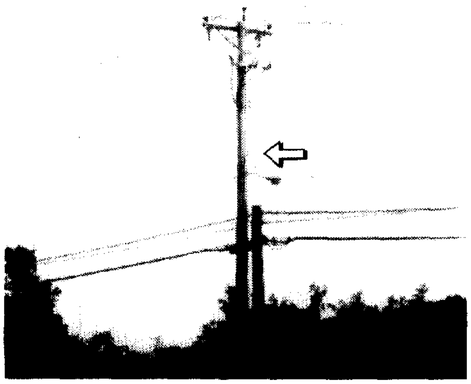


Photo 1 — CATV Riser Cable Loops Up From Messenger Before Going Down the Pole

Thus, the actual spacing of the bolt holes for the brackets supporting the lowest supply item and the highest communication item usually exceeds the table clearance value by at least 8 inches.

In fact, the NESC used to specify a minimum spacing of 48 inches between bolt holes and a minumum clearance of 40 inches between wires, as shown in Figure 1.

Since the 48 inches between the crossarms is a design issue, rather than a performance requirement, that specification was removed from the code several editions ago.

However, 48 inches is still often the minimum spacing required between bolt holes to meet good practice for short span installations. See Figure 2.

Longer spans typically require greater clearances because of the differences in sags, as will be discussed below.

Footnote 6 of Table 235-5 allows the basic 40-inch value to be reduced to 30 inches if (a) the supply item above the communication is either an effectively grounded neutral meeting Rule 230E1 or a special electric supply cable construction (that includes a grounded sheath or shield around insulated energized conductors) meeting Rule 230C1 and (b) the neutral is bonded to the communication messenger.

Although it is common to encounter a supply neutral below the high-voltage distribution-voltage conductors without accompanying energized secondary voltage cables or conductors, it is not common to encounter a cable meeting 230C1.

The common duplex, triplex, or quadruplex secondary voltage or service voltage cables do not have a grounded sheath or shield and only meet Rule 230C3, thus requiring the full 40 inches.

Even if a neutral is the lowest supply conductor in the span today, it may need to be replaced with a secondary cable or conductors in the future. Thus it is common to allow space for such installation in any make-ready inspections. However, that may result in changing out too many poles early with little gained as a result, if secondary is not needed in the future.

Several innovative, cooperating utilities have made agreements to end this problem. Where the reduction to the 30-inch clearance to a neutral is allowed to be used, the agreement for such use usually requires two things to occur. First, the structure is identified and recorded as having the reduced clearance, so that the power utility will know that, if future plans should require a secondary installation, the pole will need to be changed out before going out to install the secondary. Second, the communication utility agrees to pay for the pole replacement, if and when needed. This innovative agreement is working well for those using it.

The basic vertical clearance values of Table 235-5 apply between the lowest service conductor, cable, or jumper of the supply system to the highest conductor, cable, or jumper of the communication system.

If the lowest supply item or highest communication item is a bracket, Rule 238 requires the same clearances as Rule 235 from the brackets, cables or conductors of the one type to the brackets, cables or conductors of the other type.

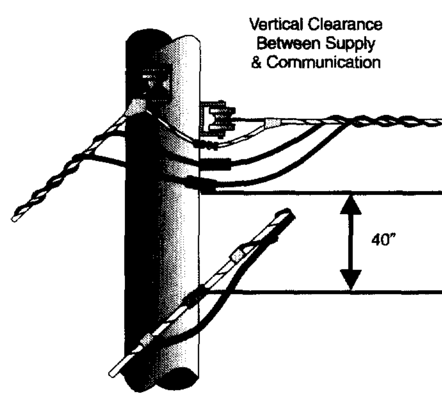


Figure 2 — Present NESC Requirements

Rule 238 also recognizes the reduced clearance of 30 inches, if the supply item is a grounded transformer tank or 230E1 neutral. The larger the brackets involved, the larger will be the bolt-hole spacing required to maintain the required clearances at the pole.

Similarly, the greater the supply jumpers hang below the bracket, or the greater the communication jumpers extend above their brackets, the greater will be the required bolt hole spacing to produce the required worker safety zone between the supply space and the communication space. See Figure 3.

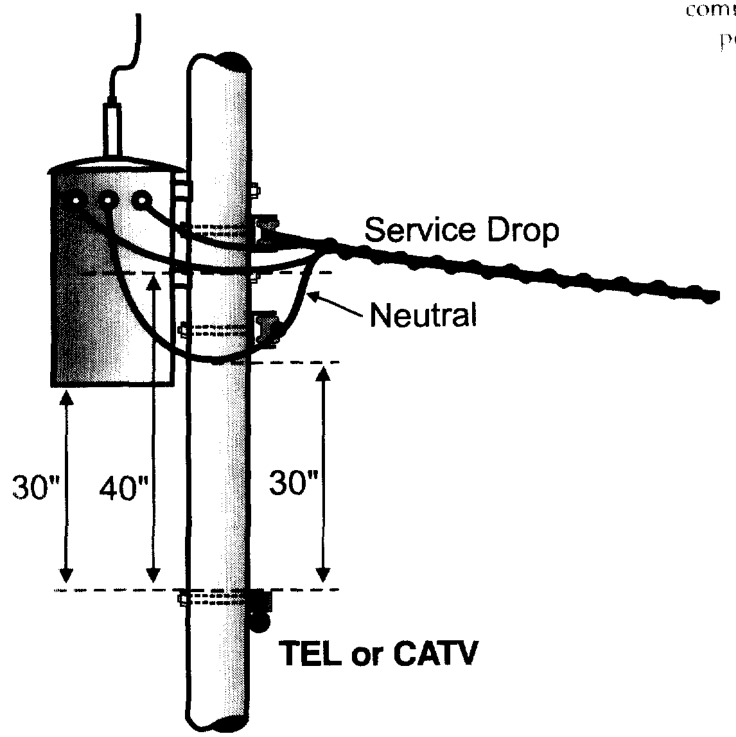


Figure 3 — Worker Safety Zone

The care taken in the planning and installation of a given communication addition to a joint-use pole greatly affects the required clearance between the main line cables and conductors. For example, Photos 2 and 3 show an installation where the CATV cable is mounted approximately 4 ft below the power secondary cable and 36 inches below the transformer tank.

Neither the main line CATV cable messenger nor the communication service drop level is the required 40 inches below the secondary jumpers running from the transformer to the secondary cable. The CATV cable expansion loop is improperly trained in an upward direction, creating an even worse NESC violation.

Items allowed in the worker safety zone

Rule 238 recognizes that for safety reasons relating to height above ground, traffic signal span wires and brackets and street light brackets (both of which are worked by qualified supply workers) may have to be located in the worker safety zone between the communication and power systems.

The power supply leads to the traffic signals are not allowed in this space. However, due to their construction, the power supply leads to street lights often enter from the bottom of the bracket. When they do, and when they must be located in the worker safety zone, special clearances and insulation rules apply.

The Clearances Subcommittee of the National Electrical Safety Code Committee considered removing this provision from the Code, in order to better maintain the worker safety zone between, and the visual separation of, the electric supply conductors and cables from the communication cables and conductors.

However, the safety concerns for proper location of such lights for the safety of the public led the subcommittee to conclude that the present provisions should be maintained. If such a bracket is required to be located in the worker safety zone, Rule 238 contains clearance requirements between these items and communication items to allow safe work by the qualified communication workers.

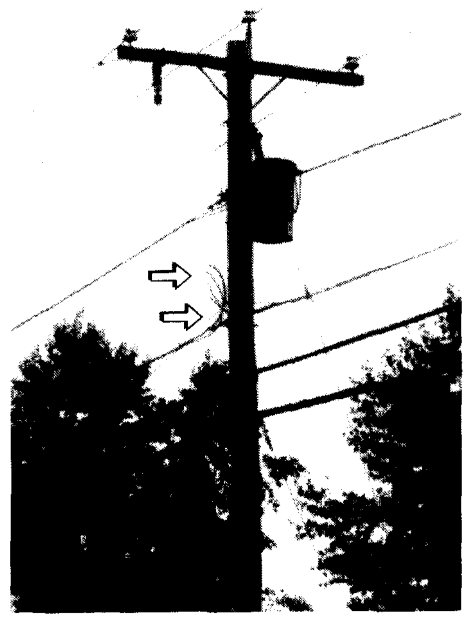


Photo 3 — Improperly Trained Communication Cable and Improperly Located Communication Service Drop

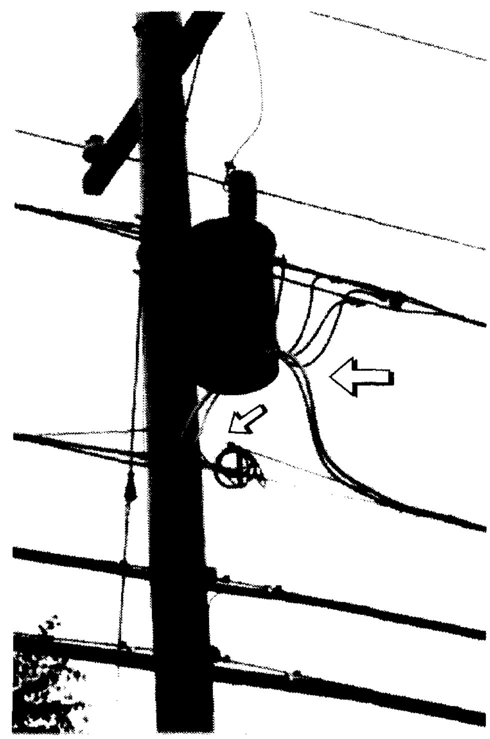


Photo 2 — Improperly Trained Communication Cable and Improperly Located Communication Service Drop

The operational requirements of traffic signal bracket and luminaire bracket location are flexible enough that they can be fitted between other items on a pole *without requiring extra pole height*. This is a key issue in considering the impact of adding new facilities to a pole. Adding new cable locations requires additional pole height, but adding luminaires or traffic signals does not, except in the rare extraordinary situation.

Sag-related clearances

Sag is the gravitational displacement of a conductor or cable below the line-of-sight between its points of attachment to the structures at each end of the span. Rule 235C2b(1)(a) requires that differences in the sags of the upper and lower conductors or cables be recognized.

Under Rule 235C2b(1)(a), the clearance at midspan (when the upper conductor or cable is at its maximum sag) must never be less than 75% of the value required at the structure by Rule 235C1. Thus, when 40 inches is required at the pole, 30 inches is required in midspan.

The Exception to Rule 235C2b(1)(a) allows a supply neutral to have a vertical clearance from communication cables of 30 inches at the pole and 12 inches in midspan. Under Rule 230F, most fiber optic supply cables (FOSC), i.e., fiber optic cables placed in the supply space under applicable rules, are treated the same as neutrals meeting Rule 230E1 and, thus, could have the same clearances as a supply neutral to cables located in the communication space. See Figure 4.

If the maximum sag of the upper conductor or cable is more than the sag of the lower conductor or cable (under the same ambient air conditions) by a sag difference greater than 10 inches (or 25% of the structure attachment clearance value required by Rule 235C1), then Rule 235C2b(1)(a) requires the clearance at the attachment points to be increased until the midspan clearance is at least 30 inches (or 75% of the value required by Rule 235C1). See Figure 5.

Thus, for the longer spans, the vertical clearance between the highest communication cable or conductor and the lowest supply cable or conductor may be several times the basic clearance required by Rule 235C1 and Table 235-5.

Similar increases in the clearance at the pole are required when the sag characteristics of the cables or conductors are significantly different.

The solid lines of Figure 6 show the typical relationships of power and telephone conductors and cables. There is enough sag in normal telephone cables that they lay under the supply cables in spoon fashion, often without requiring more than the NESC basic clearances at the structure.

Increased clearances are often required when coaxial cables (CATV) or fiber-optic cables are placed under the power cable. These cables are lighter and have less sag than copper-pair telephone cables. Thus, they force the supply facilities to move up at the attachment point, in order to achieve the required midspan sag.

Similarly, if a fiber-optic cable with small sag is installed (under rules to be discussed later) as the lowest item in the supply space, the other supply facilities may need to be moved up to achieve the required 30 inches at the pole from the *fiber optic supply cable* (FOSC) to the cables located in the communication space.

Electric supply jumpers usually hang no more than 10 inches below the supply attachment level, while the midspan sag typically exceeds 10 inches of sag. Thus, supply jumpers do not normally hang further down from the attachment bolt level than the midspan level of the cable or conductors.

Since the midspan clearance above ground usually controls attachment height, jumpers for the electric supply

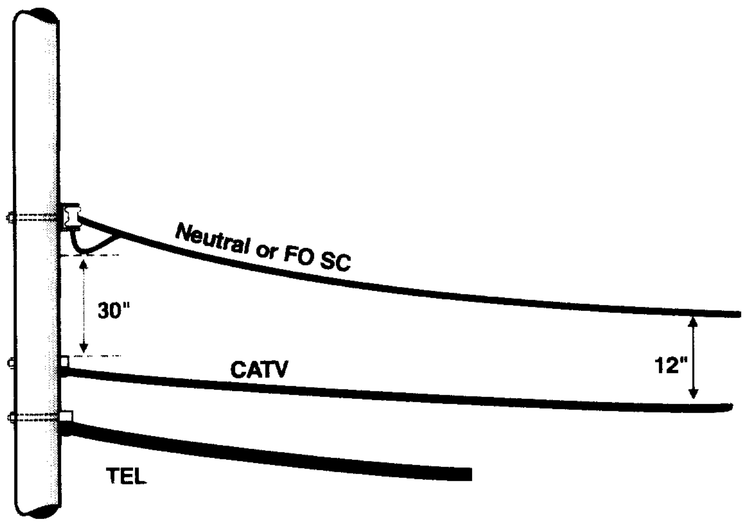


Figure 4 — Neutral or Fiber-Optic Supply Cable Clearance to Communication

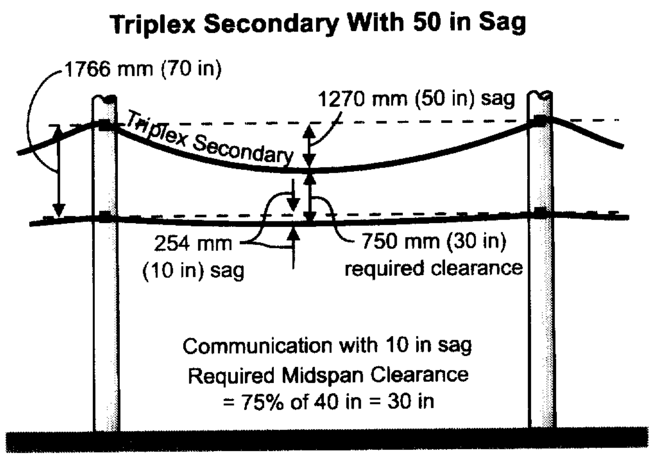


Figure 5 — Clearance at Pole Based Upon Midspan Clearance

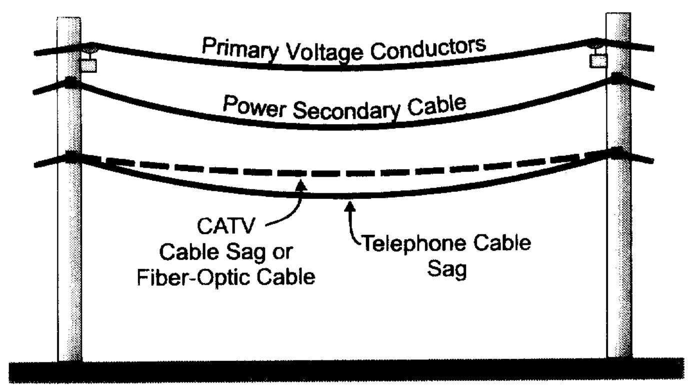


Figure 6 — Sag Comparisons

conductor connections do not require additional pole height.

In contrast, any extensions of the communication equipment or jumpers above their attachment bolt level usually requires additional pole length between the attachment bolt locations, except on the longest spans.

Key determinants of vertical clearances

Except for very short spans, the key determinants for the clearances required at the pole between supply and communication attachments are the relative sag characteristics of each cable or conductor. As a result, these relative sag differences and the required NESC basic clearance determine the amount of extra pole length required to add communication to a power pole (or power to a communication pole).

For the purposes of the sag-related clearances of Rule 235C2b(1)(a), the upper conductor or cable must be considered to be at its lowest position (greatest sag). This will occur under ice loading or thermal loading.

The lower conductor or cable must be considered to be unloaded and at the same ambient temperature that produces the determinant sag on the upper cable or conductor.

Summer midspan clearance conditions

Line losses caused by the resistance of the conductor to the flow of electric current are proportional to the square of the current involved. Line Losses heat the conductor, similar to friction heating of a sliding object.

If the worst-case sag of the upper conductor is in the summer, (due to air conditioning load on the hottest day), the sag of the lower conductor or cable that must be considered is that which occurs at the same ambient air temperature, solar insolation (heating from the sun), and wind cooling conditions as those affecting the upper conductor.

For example, if the greatest sag of the electric supply secondary conductors is when they heat up to 212 °F on a 98 °F day (with heating from line losses and the sun), the lower cable messenger or conductor must be considered with its respective temperature increase from the sun, but not from any electrical loading that might be present. It is easy to always think of having the lower cable or conductor out of service and being replaced to determine the applicable sag of the lower cable or conductor.

For example, depending upon the insolation level, the lower conductor or cable might be at 103 °F when the upper one is at 212 °F on a 98 °F day. At that time, the clearance between them in midspan must be no less than 75% of that required at the pole, or 30 inches, without electrical loading.

Obviously, if the lower conductor or cable were in service and was at elevated temperatures due to electrical loading, the required midspan clearance would be greater, in order to assure 30 inches of clearance when the lower one was unloaded.

Winter midspan clearance conditions

Ice loading affects small conductors more than large conductors. Ice tends to act as an insulator, preventing the conductor from cooling as fast as it might in free air. Thus, for many installations in icing areas of the country, the sag of the upper conductor or cable at 32 °F with the required ice loading (½-inch or ¼-inch of radial, as applicable for the loading district) will be determinant.

Since the greatest sag of an ice loaded conductor will be at 32 °F (additional heating from line losses will begin to melt the ice off and lighten the conductor) 32 °F is the assumed temperature of the upper conductor.

Although ice tends to form on a conductor only in a relatively narrow temperature range near 30 °F, ice can stay on the conductor as the temperature drops to lower temperatures.

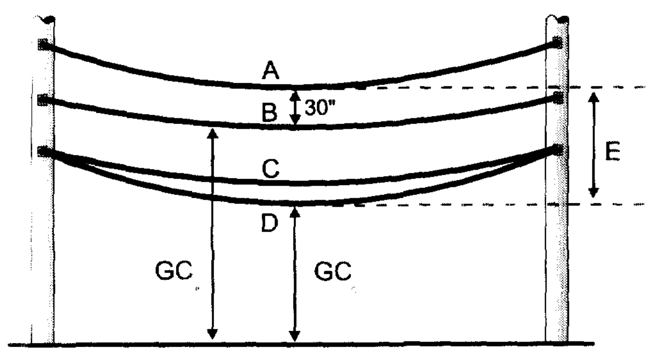
If the upper, ice-covered conductor is heated due to line losses from the electric heating load on the cold nights, the appropriate ambient temperature for the lower conductor position will be a temperature that is colder than 32 °F.

In urban areas, it is not unusual for there to be enough electric load on an ice-covered conductor for the conductor to warm up to 32 °F on a 0 °F day. In such a case, the lower cable or conductor must have the required 30 inches of clearance when the upper conductor or cable is heated up to 32 °F (and still retains its ice) and the lower conductor or cable is without ice at 0 °F.

Required pole length

The total additional pole length required for such an installation would, thus, be the 30-inch basic clearance *plus* the change in sag of the lower conductor or cable from (a) the ambient temperature used to determine the maximum sag of the upper conductor to (b) the position of greatest sag of the lower conductor due to ice or thermal loading.

Figure 7 shows the information needed to calculate the additional pole height required to meet NESC clearances at midspan.



A = Maximum sag position of supply secondary cable
B = Position of highest communication cable under the ambient conductors that determine A
C = Position of lowest communication cable under the ambient conductors that determine A
D = Maximum sag position of lowest communication cable
E = Extra pole height required for communication space
GC_C = Ground clearance required for communication
GC_P = Ground clearance required for power

Figure 7 — Additional Pole Height Required to Meet NESC Midspan Clearances

The ground clearance required for a supply neutral at midspan is the same as that for a communication cable. The ground clearance required for a supply secondary (service) voltage cable is the same as that for an open-wire communication conductor, and is 6 inches greater than required for a neutral or communication cable.

The additional pole height required to add a communication space below a power secondary cable and meet NESC clearances at midspan is, therefore, the value of E from Figure 7, less 6 inches, plus an appropriate allowance for errors in stringing sags and tensions, later movement of poles, etc. Thus, the extra pole height required for short spans is at least the value of E. Longer spans require a greater allowance to assure future compliance with the NESC.

The pole length will have to be great enough to allow for the greater of (a) the basic clearance between the items at the pole (including the jumpers and brackets), (b) the extra length required to allow required clearances in the summer, or (c) the extra length required to allow required midspan clearances under ice loading.

Installing conductors and cables with desired sags and tensions is a mixture of craft and science. It is difficult to know exactly the temperature of the items being pulled in. In addition, as a conductor or messenger is pulled into place it begins to stretch and start the transformation from its initial unstressed length to its final sag characteristics. Thus it is difficult to know when it has been sagged and tensioned correctly. It is typical to allow a "grace factor" based upon span length to take care of problems with tensioning conductors and cable messengers and assure that clearance requirements will be met.

Pole Loading and Required Strength

Poles are specified as to length and strength class. Poles are required by NESC Sections 24, 25 and 26 to be able to withstand required assumed transverse, longitudinal, and vertical loadings and required overload factors (safety factors) without overstressing the materials involved.

Transverse loads come from wind on the poles and supported facilities and tend to overturn the pole or break it.

Longitudinal loads are along the line; they come from wire tensions, mismatches in wire tensions, changes in the angle of the line, differences in span lengths, differentials in ice loadings from one span to the next, and misapplied guying effects.

Vertical loads come from the weight of all facilities (included upper portions of the structure and ice loading) supported by the structure; they also include the effects of eccentric loading, if poles are pulled over by misguying, etc.

If the work will always be performed by qualified electric supply workers using OSHA and NESC work rules for supply workers, lesser clearances are specifically allowed from communication facilities to electric supply facilities.

These loads can also affect clearances as they change from season to season, and the NESC requires such changes to be taken into account.

Overturning moments on poles are a function of the transverse loads applied to the poles and the heights of each of these loads above ground. The moment is the product of the load times the height above ground at which it is applied to the structure.

The electric supply wires and equipment at the top of poles have longer lever arms (from the ground line) than the communication facilities located below and, thus, will have a greater overturning moment for a given diameter of cable or conductor.

However, many of the communication cables are so much larger than the power conductors that the additional wind load transferred to the poles by the communication cables more than offsets the reduced lever arm.

Large communication cables are often the greatest vertical loads supported on a pole. It is not unusual for the greatest overturning moments on the poles to be those created by the communication cables. It is also not unusual for the greatest longitudinal loads to be caused by communication cable messenger tensions. Thus, a proportionately larger share of the cost of the pole related to pole class is frequently caused by the addition of the communication cables.

Effect of work methods on required clearances

The above discussion assumes that the work on the communication lines and equipment will be performed by communication workers meeting the OSHA and NESC work rule requirements for communication workers.

If the work will always be performed by qualified electric supply workers using OSHA and NESC work rules for supply workers, lesser clearances are specifically allowed from communication facilities to electric supply facilities.

Significant differences exist between the training, supervision, procedures, and equipment used by supply workers, not the least of which is that communication workers typically use conductive metal buckets and booms, while supply workers use the more expensive, *insulated* glass-fiber reinforced booms and buckets.

Power companies have always had the need for communication between their respective facilities and have typically installed a communication system along key transmission routes to efficiently operate their systems. In Rules 224 and 235, the NESC used to recognize these systems *as communication used exclusively in the operation of supply.*

With the advent of the fiber-optic communication cable systems capable of carrying massive data and communication signals, the Code was overhauled to recognize the true issues involved. Those principally concerned the safety of the workers who installed and maintained these systems.

There is no safety issue with respect to the type of information carried, so Rules 224 and 235 were revised. These rules now recognize the possibility of supply and communication utilities sharing the same line or cable.

Rule 224A now recognizes the constraints necessary when any communication cable is to be installed in the supply space:

Communication circuits located in the supply space shall be installed and maintained only by personnel *authorized* and *qualified* to work in the supply space in accordance with the applicable rules of Sections 42 and 44 (emphasis added).

Section 42 applies to all electric supply and communication workers. Section 43 contains the few additional rules applicable to communication workers, including the approach distances required from supply facilities.

Section 44 contains the additional rules that apply to electric supply workers. The difference between the training of supply workers and communication workers is typically years. Because of the safety issues involved with working in the high-voltage spaces, electric supply workers can only be gradually upgraded in allowed duties.

The training, supervision, tools, equipment and protective apparel and devices required for supply workers are time consuming and costly, compared to that required for most communication workers.

Special constraints are also required by Rule 224A to limit the voltage that can be transferred on the communication circuits and cables from the supply space to the communication space, when it is necessary to bring such circuits down into the communication space or over to a public place or served structure.

Since the power utilities already must meet these concerns to work on the power lines and equipment, it is not unusual for electric supply utilities to install all of their communication lines and equipment in the supply space.

As a result of the additional safety concerns and related expenses that must be considered when placing any communication line in the supply space, it has so far rarely been economical for communication utilities to place their facilities in the supply space on a joint-use structure. Thus, the most common joint-use structures designate a communication space below the supply space.

However, as available pole space becomes more of a problem, many communication utilities are adding personnel qualified to work in the supply space in order to eliminate the need for a separate communication space.

Construction Standards and Make-Ready Inspections.

To assure required safety, it is appropriate to conduct a make-ready inspection of every span and structure for which joint-use attachments are proposed. However, it is usually not cost effective to conduct a complete analysis of every proposed joint-use addition.

Normally it is better to make appropriate basic agreements and standards that specify what can be added in what kinds of situations (span lengths, pole sizes, etc.) and set up an appropriate review procedure for the odd situations.

Of necessity, such a standard system requires that clearances and strengths be provided to take care of all but the extreme installations expected. Thus, extra clearance or strength will exist for some installations; others will be special cases.

The cost of adding extra clearances or pole strength into the standards to take care of a range of conditions is typically less than requiring a detailed analysis of sags and tensions on each situation.

As a part of such practical standards, it is often appropriate for tables or charts to specify maximum sags of supply conductors and cables and minimum sags of communication conductors and cables. Each type of conductor or cable must be readily identified by any party if they are to install appropriate clearances and strengths in their own installations.

Any time one utility lets employees of another utility work on its pole, the owning utility is exposed to liability issues.

Within certain normal span length limitations this is relatively easy to create and use. For any specific installation, (1) adding the 30-inch midspan clearance to the maximum sag of the supply conductor or cable (plus a span-related safety factor) and (2) subtracting the minimum sag of the communication item will yield the required spacing between the attachments.

The above method is an appropriate method for determining the additional length of pole required for joint use installations to achieve required midspan clearances. It must be compared with the 40-inch requirement at the pole (plus appropriate adjustments for jumpers, equipment, and other intervening items) to see which clearance requirement actually governs.

Joint-Use Rate Issues

It is not unusual for extreme arguments to occur between joint-use parties as to how to properly allocate the space on a pole and the costs thereof. These disagreements often include arguments as to (1) what exactly is the *usable space* on a pole, (2) what portion of that should be allocated to each party, and (3) what costs or expenses should be included in the calculations? This discussion addresses the first two of these issues; the latter one is directly related to the first two, but not discussed in detail here.

Because of these disagreements, and because of concerns about the potential stifling of fledgling communication systems, the Federal Communications Commission (FCC) was forced by legislation to help keep such cost allocations fair to all parties.

FCC efforts have, of necessity, had to focus on relatively simple allocation methodologies. This has both helped and hindered this process, as is discussed later.

The above issues are not, however, the only issues. In some situations, some of those arguments may be relatively minor when compared to other issues, such as (1) accident litigation, (2) reduced reliability, (3) increased operating costs, and (4) reduced structure life.

Litigation issues

Any time one utility lets employees of another utility work on its pole, the owning utility is exposed to liability issues. This is particularly true when communication workers are allowed on a joint-use power pole. Even if the standard indemnification contracts are held valid and have the communication utility (or contractor) pick up the cost of any litigation judgment or settlement, few of such contracts adequately reimburse the owning utility for all of the time and cost associated with its own personnel being involved in the case.

Out-of-pocket costs of attorneys, expert witnesses, travel, copies, etc., are often exceeded by the fully allocated costs of the time and expenses of the company executives, line workers, investigators, managers and related personnel who must interrupt their work to deal with these issues (usually on someone else's time frame, rather than a convenient one).

Recent years have shown an increasing amount of problems caused by a communication utility adding a new cable and improperly guying or tensioning the cable messenger. Any new cable that is overtensioned enough to displace the poles will cause all of the existing cables or conductors increase in sag. The result may be clearance violations for ground clearance or conductor to cable clearance.

Some vertical or horizontal power line clearances have been changed enough to allow contact from personnel performing acts underneath the line. Others have been displaced horizontally enough to cause code violations to billboards, buildings and the like. The result of such occurrences is an economic liability to all other parties on the pole, but especially to the electric utility.

The increased operating costs from litigation liability can only be limited by direct action of the utilities who add items to the structures. In an ideal cost allocation formula, the nonowning users will bear all of that very real cost.

Reliability and operating cost issues

Experience shows that having other workers and other facilities on your structures leads to failure problems and service problems that would not otherwise occur. Such occurrences result in both economic losses (due to repair and customer usage not billed) and, in extreme cases, trouble with the public service commission due to increased outages.

NESC and OSHA work practices require grounded items in the work space to be covered with insulating materials when working above 300 volts phase-to-phase (i.e, any secondary above 277/480 V and all primary voltages).

Any time that electric supply workers have to climb above communication cables (such as during storm restoration work or when working on poles on back lot lines, where trucks can't get in), it increases the time required to cover up and climb around or through the communication facilities to get to their own. The overall result is slower storm restoration and requirements for greater numbers of line personnel.

Similarly, poles with several riser conduits leading to underground cable runs are difficult to climb and may require use of a bucket truck.

Life span issues

The NESC recognizes that poles decay over time, especially at the ground line. New poles must have enough strength to meet required overload capacities *at installation*. Existing poles must be replaced (or structurally assisted) before their overload capacity falls below that require by the NESC *at replacement*.

If additional facilities are added to an existing structure, they increase the loads and reduce the overload capacity of the structure, thus reducing the remaining life of the pole. This results in premature replacements of otherwise good poles and increases the costs of the owning utility.

When the addition of new facilities shortens the pole life or requires a new pole, it costs every pole occupant, since all will have to pay to change their facilities to a new pole sooner than expected.

Cost allocation methods

The principal method in use is a variant on a fully allocated cost method, as opposed to an incremental cost method.

There are a variety of ways to consider the costs and benefits to each utility of having joint-use facilities. Each suffers from problems in obtaining appropriate data and each method in use today tends to be overly simplified. As a result, unless best-guess fudge factors are employed, the owning utility rarely recovers appropriate revenue to reflect all of the life-cycle costs associated with the joint use of its facilities.

Many of the present rates are based upon the FCC formula which does not appropriately reflect all costs. The FCC formula divides the pole length between that which is *usable* and that which is not. It then attempts to determine the costs associated with the pole installation (excluding specific electric facilities) and apportion those costs to each utility.

Usable space

It should be obvious that space renters will benefit from any allocation of pole costs that shows more of the pole length being usable to the pole owner and less usable to them.

In its simplest sense, the FCC formula assumes that all space above the level of the lowest communication attachment is *usable space*.

In a variety of proceedings, communication utilities have argued that the usable space starts at 18 ft above ground level at the communication attachment level. They then subtract 18 ft from the average installed pole height to determine the usable space.

Using the FCC formula with such input understates the impact of communication utility facilities and overstates the responsibility of the electric supply facilities, thus reducing pole attachment rates below appropriate levels.

Pole height

The required pole height is a function of (1) the number of facilities installed on the pole, (2) the type of facilities installed on the pole, (3) the span lengths, and (4) the terrain.

Conductors and cables match the configuration of a catenary curve. The sag at the quarter point in the span is 76.5% of the total midspan sag.

Figure 8 shows the sag curve for a conductor and shows the relative mounting height of a long span and a span of half its length. This sag curve shows a maximum sag of 2 ft for the communication cable for the short span. If the short span poles are located at the quarter-span points of the longer span, the maximum sag of the long span would be the result of 2 ft divided by (1 – 0.765 = 0.235) = 8.5 ft. Thus the mounting height for the long span would be 24.5 ft.

Figure 8 illustrates several clear points. Using twice the span length eliminated a whole pole at the expense of requiring an additional 6.5 ft of pole length.

Figure 9 shows the effect on mounting height when tall poles are used in depressions to maintain appropriate line levels to prevent uplift problems.

Some communication utilities using the simplistic FCC model have argued that there is an average of 11 ft of usable space on a 35-ft pole and 16 ft of usable space on a 40-ft pole. This is clearly a

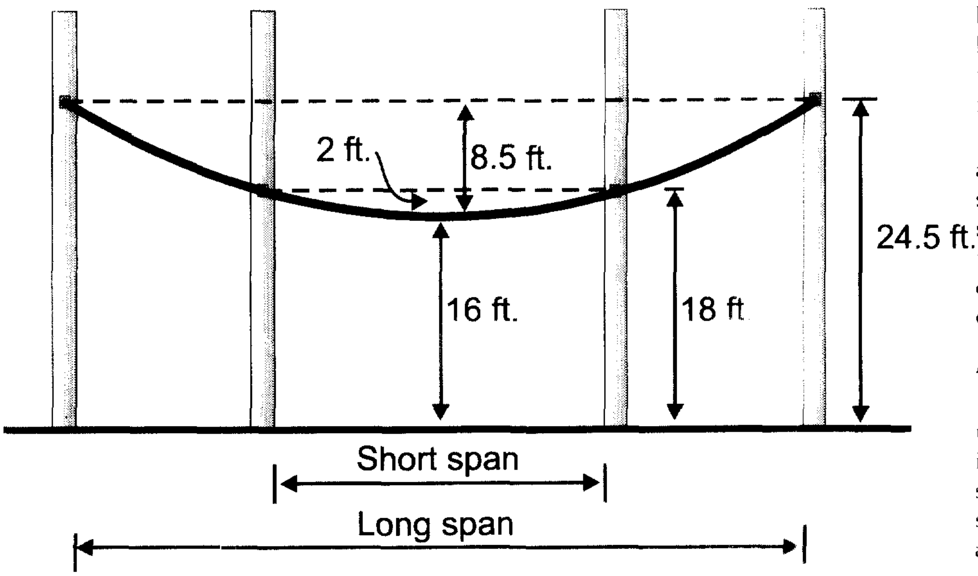


Figure 8 — Relative Mounting Heights for Long and Short Spans

specious argument in uneven terrain and in areas with any terrain where long spans are practical.

The height of a pole is a function of the vertical space needed by the power facilities, the vertical space needed by the communication facilities (including the worker safety zone between those facilities, if required by the communication utility work methods), and the terrain.

In essence, the length of the top portion of a pole is set by the needs of the utilities and typically does not vary much for a given line. However, terrain forces the bottom part of the pole to be extended for many poles, in order to get over terrain obstacles and to gradually grade the rise and fall of the cables and conductors as they start up and start down hills or fill in gullies.

The result is that most of the need for 40-ft poles is caused by terrain, not the need of the respective utilities.

In the United States, the predominant construction for rural power lines, with power and telephone only, has been with 30-ft poles. In flatter terrain 25-ft poles have been used in many areas of the country for longer spans of power only or medium spans of power and telephone. Many of these poles are small: Class 7 or Class 6. Pole class numbers run inversely to size, similar to the American Wire Gauge (AWG). A Class 6 pole is larger than a Class 7 pole.

In recent years, the basic pole used by most electric utilities has been 35-ft poles (typically of Class 5 or 4). Today, many utilities have switched to 40-ft or 45-ft (Class 40 to Class 2) poles for the basic length, to plan ahead for multiple communication cables, power secondary cables, and rolling terrain.

For any practical purpose, the maximum pole size that should be used on many systems for space allocation purposes is a 35-ft pole, and a good argument can be made for shorter pole; the additional height of the taller poles is typically related to terrain or to expectations for numerous communication attachments.

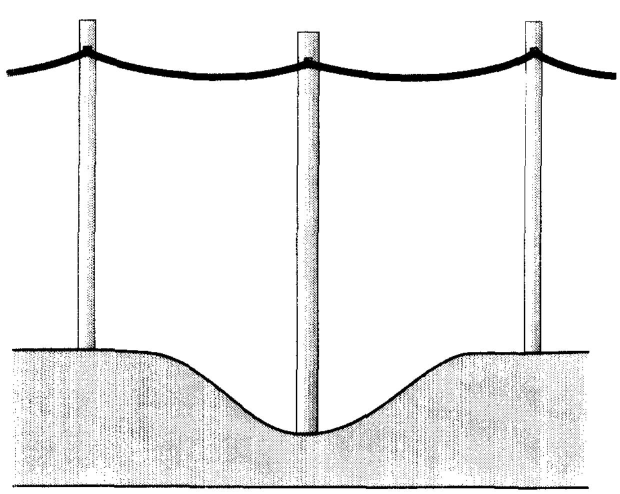


Figure 9 — Use of Tall Poles in uneven Terrain

Any allocation formula that uses the average installed pole height but fixes the start of the usable space at 18 ft understates the start of the usable space and ultimately overstates the amount allocated to the supply utility and unduly discriminates against them.

Attachments at the top of a pole

The FCC formula includes all of the top part of the pole. Since the true issues in pole cost allocation proceedings are simply how much pole length (and strength) do you need for everyone to attach, the FCC formula overstates the amount of the pole attributable to use by electric utilities.

Wood poles decay. The top of the pole, where the ends of the wood fibers are exposed to sun and rain are especially vulnerable. During the normal life of a pole, cracks will form a the top of the pole due to expansion and contraction with wetting and drying cycles and biological decay.

All kinds of methods have been attempted to decrease the degradation of the top of the pole, including cutting the top with a roof or slant (rather than straight across) and using a metal cap. In most areas, none seem to work any better than a straight cut.

If bolt holes are drilled too near the top of a pole, uneven loading of the pole will cause the top of the pole to split out, thus causing premature replacement. Uneven loading is expected on most poles due to differences in span lengths, differences in elevations of poles on either side, wind loading, uneven dropping of ice and similar factors.

Decades of good and bad history has shown that, for most areas of the country, no hole should be spaced closer than 5 inches to the top of the pole. Closer locations result in pole splits and, in many cases, catastrophic failure.

Some communication utilities argue that the top 5 inches of the pole should be included in the usable space because (1) electric utilities routinely use pole top insulator pin supports and pole top extensions. Neither of these arguments stands up under close examination. Both overly penalize the electric utilities.

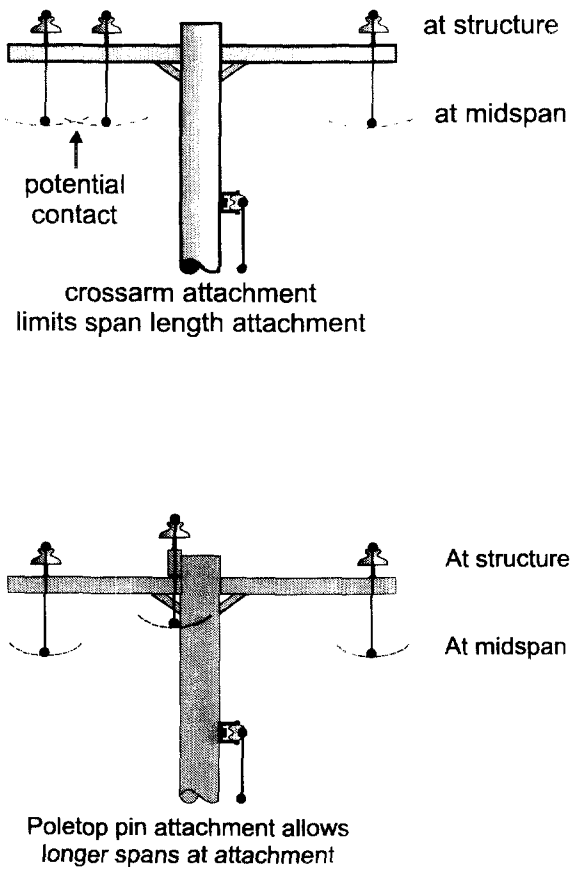


Figure 10 — Comparison of Pole Top Pin and Crossarm Pin Attachments

First, consider the pole top pin issue. Figure 10 shows the effect of using a pole top pin instead of the less expensive crossarm pin to mount the supporting insulators.

By using the more expensive pole top pin, the center phase conductor is raised above (and out of potential swinging conflict with) the other two conductors. This greatly increases the span length that can safely be carried. Shorter spans are required if crossarm pins are used. Shorter spans require more poles and more attachment fees.

Figure 11 shows a pole top extender supporting an overhead shield wire above the electric phase conductors.

Pole extenders are not normally used. With the exception of some island installations where taller poles cannot be shipped in, taller poles are used to supply additional height for new installations.

Most uses of pole extenders result from problems found after installation of the original line, such as extraordinary lightning problems that required the addition of, or replacement of the neutral with, an effectively grounded overhead shield wire.

Some of these installations resulted from moving the supply neutral up into an overhead shield wire position to allow more communication cables to be attached.

Obviously, any such addition increases the loading on the pole and decreases the life of an existing pole, but this is often preferable to changing out a presently useful pole.

But for the frequent use of pole top pins and the occasional use of pole extenders, the costs to the communication utilities would increase for the additional pole changeouts or attachment points.

The NESC limits allowed stresses to specified percentages of the rated strength of the materials or parts. Some communication utilities have argued that the top 5 inches of the pole should be included as usable space because it strengthens the pole top pin or extension installation. While that might be argued for transverse forces pulling toward the pole, it is not true for transverse forces in the other direction or for longitudinal forces in either direction. In addition, such units have a rating that is equal in all directions. The top 5 inches of the pole cannot be considered to help.

For these reasons, it is appropriate to include the extra cost of any pole top pin installation or pole extender installation in the costs shared by all (because they benefit all). However, it is not appropriate to include the last 5 inches of the pole as usable space (because nothing can safely be mounted higher than that). The usable space starts at the lowest communication attachment point and ends 5 inches below the top of the pole, but it is not continuous and should not include the worker safety zone.

Photo 4 shows a typical communication installation (albeit relatively lacking in neatness) with a splice box and other communication installations hanging or attached below the main communication cable.

It seems inconsistent for communication to argue that the top 5 inches of the pole should be included in the usable space to be allocated, without also including the next few feet down below the lowest communication cable, where it is common to find communication splice boxes and other equipment.

The worker safety zone

If communication utilities choose for whatever reason to meet desires or requirements to run their facilities overhead on joint-use poles, rather than on separate poles or underground, the communication utilities have two choices.

One choice is to train their employees to use the supply worker work methods, safety rules, insulated equipment, etc., and place their facilities in the supply space on the pole (with permission of the supply utility). This choice is gaining favor today, especially for some alternative communication system installations.

If they choose not to meet the same requirements as supply workers, they can have a worker safety zone installed on the

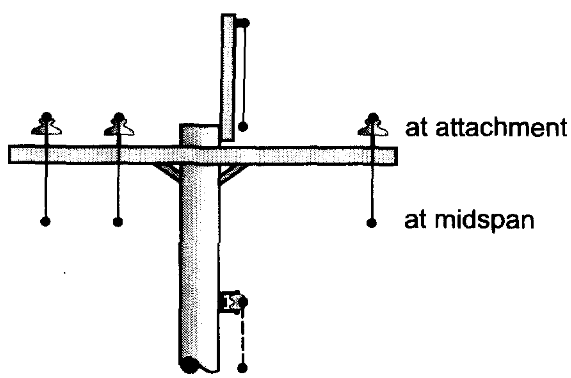


Figure 11 — Pole Top Extension

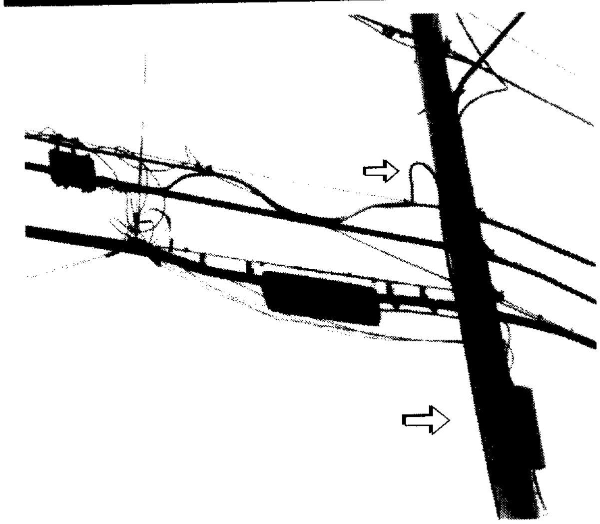


Photo 4 — Communication Equipment Mounted Below Cable

pole and locate all of their facilities in a separate communication space that is separated from the supply facilities by the required worker safety zone.

The NESC does not require a worker safety zone on the pole if the communication workers are trained and equipped to work in the supply space. The only reason that a worker safety zone is required is because of the choice of the communication utilities who desire to use personnel with lesser qualifications.

The cost of the space required for the worker safety zone should be borne entirely by the communication utility or utilities who choose to have the space installed.

Surplus space

Some CATV utilities have argued that "the space used by cable on poles is pure surplus". They argue that there is usually room on the pole and they shouldn't have to pay if aren't the catalyst that requires a pole changeout.

In these days of universal downsizings of utility work forces, no utility has extra people on staff to run around changing poles out that don't need to be changed.

Most electric utilities plan ahead well enough that, if they are installing a new pole line in an area that they expect new cable facilities will be installed during its life, they will go ahead and install enough pole to allow for the future attachment.

That is one reason that many of the poles today have the clearance already on the pole for cable to attach. If the attachment doesn't come, they end up eating the extra cost (which is not figured into the present cost allocation schemes).

Even though a communication utility may start paying pole rent once it attaches, present allocation formulas (such as the FCC's formula) do not appropriately reimburse the electric utility for the earlier years' costs of making that space available.

Some recognition of recovering total life costs of existing poles should be added to allocation formulas to promote installation of new poles with room for *expected* additions.

It makes no sense to penalize a forward thinking utility who installs extra space on a pole so that the pole won't have to be changed out in midlife. If such an argument is adopted, then the only recourse available to electric utilities (on behalf of their own ratepayers) would be to stop looking ahead and installing extra room on poles for future communication attachments.

Such a policy makes no sense. There are already enough poles in place that will require replacement to make room for new communication attachments without adding to the stock. In the future, this problem will be even more severe.

Overlashing New Cables on Existing Messengers and Cables

Disagreements often arise when a communication utility wants to lash a new cable to an existing cable and messenger, without paying an additional attachment fee. Adding new cables to existing messengers (1) adds vertical, transverse, and horizontal loads to a pole and (2) changes the sag characteristics of the new bundle.

Depending upon what is below the cable at issue, overlashing a new cable may or may not change the required length of the pole, but it can cause a code violation by overloading the structure. Overlashing addition cables on existing messenger strands requires additional pole strength, thus reducing expected life of the existing pole—if not requiring a new pole. This argument can easily be settled by including pole loading into the joint-use agreements, with higher attachment fees for higher loads.

In island communities, the length of pole that can be shipped in is limited. To add multiple communication cables in the communication space, it is typical for all communication cables to be suspended from the ends of a 4- to 6-ft crossarm. It is also typical for a separate fee to be paid for each cable, to reflect the additional load on the pole.

Installing Communication Cables in the Supply Space

When the requirements of Rule 224A are met, communication cables and conductors may be located in the supply space. These include voltage limits, work rule requirements, and permission of the occupants of the supply space.

Table 235-5 contains the vertical clearances between communication cables located in the supply space and other items in the supply space and the communication space (if it exists). Columns apply to upper items and Rows apply to lower items.

For clearances purposes, the NESC distinguishes between open-wire communication conductors, insulated communication cables on grounded messengers, dielectric fiber-optic cables on dielectric messengers, entirely dielectric fiber-optic self-supporting cables, and fiber-optic cables containing metallic pairs. Clearances also depend upon ownership.

The basic vertical clearance between any communication conductor or cable located in the supply space and any supply conductor up to 8.7 kV-to-ground is 16 inches. This applies to open-wire communication conductors, insulated communication cables, and fiber-optic cables that include metallic components and are carried on dielectric messengers.

No vertical clearance is specified between an effectively grounded supply neutral and an insulated communication cable carried on a grounded messenger (Footnote 10). The expectation, although not specified here as it is elsewhere, is that the neutral and messenger would be bonded together.

In addition, no vertical clearance is specified between entirely dielectric fiber-optic cables and supply conductors up to 8.7 kV-to-ground. Above 8.7 kV to 50 kV,

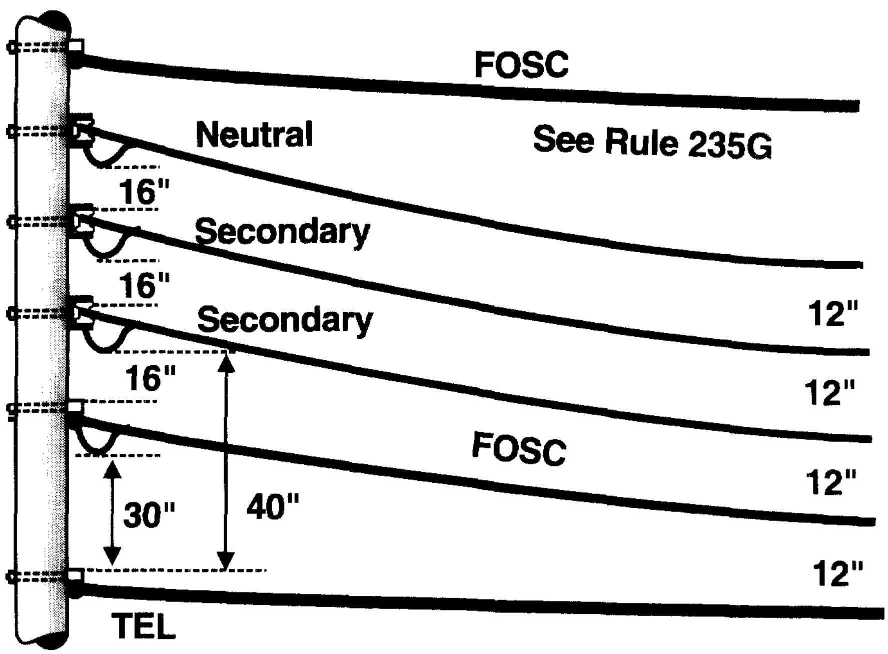


Figure 12 — Clearances for Fiber-Optic Cables Located in the Supply Space

no clearance is specified if the fiber optic cable is owned by the supply utility, but 16 inches plus a voltage adder is required if the ownership is different. See Footnote 11 of Table 235-5.

The intention of Footnotes 10 and 11 is to allow such cables to be lashed to, or allow reduced clearances to, the supply conductors concerned. These footnotes do not allow the communication cables to be installed at a conflicting location that would allow them to contact each other in midspan.

The span limits and reduced clearances of Rule 235G give guidance for installations using Footnote 10 or 11, to assure that the cable will not contact supply facilities above or below its location.

If there is a communication space on the pole, communication cables and conductors located in the supply space must have the same clearances to communication conductors and cables in the communication space as required for equivalent supply conductors and cables.

The basic vertical clearance between communication in the supply space and communication in the communication space is 40 inches. The only lesser clearance allowed is from an effectively grounded supply neutral (or a fiber-optic cable allowed to be treated like a neutral by Rule 230F) to a communication cable supported on a grounded messenger that is bonded to the supply neutral (Footnote 6 of Table 235-5). Thus, the worker safety zone is required between communication in the supply space and communication in the communication space.

Figure 12 illustrates the basic clearances required for a fiber-optic cable installed in the supply space from secondary conductors in the supply space and from items in the communication space.

Figure 12 is somewhat simplistic, in that it shows the lower FOSC with essentially the same sag as the secondary conductors. Typically, the fiber-optic cable is so light that it is not practical to have that much sag, except for short spans. On long spans, storm winds can wrap the fiber-optic cable around the lowest secondary conductor unless the fiber-optic cable is relatively taut.

The position that requires the least additional pole length is the upper position, above the neutral. The tradeoff is that the qualified supply workers who must climb the pole to work on the facilities will have to climb above the secondary to work on the fiber-optic supply cable, and this takes time. The decision is an economic one: whichever, if any, supply facilities are expected to be worked the most are generally placed lower, unless the cost of the extra pole space is prohibitive.

Communication Equipment Zone

Communication utilities routinely install local service junction boxes, splice boxes, service drop takeoffs, amplifier cases, and similar items below the point of attachment of the lowest communication cable. Most allocation formulas do not recognize use of this space by the communication utilities. Why not?

Attachment of equipment that must be climbed around causes all utilities located above to lose time when climbing the pole. Although usually small, all equipment and service drop attachments apply additional forces to the pole.

Statistical Sampling

Exact data is not available to indicate mounting heights of equipment and supports on each pole, and will never be economically collected.

Statistical sampling techniques are used throughout every manufacturing production environment to identify quality and production parameters. Utilities routinely use sampling methods to keep track of the accuracy of meters of different types and vintages to indicate when inspection/testing schedules should be changed or wholesale replacement is appropriate.

There is no technical reason why statistical sampling techniques cannot be beneficially used to determine appropriate allocation of pole space to the various occupants. The accuracy of the allocation would improve with statistical sampling to set the low attachment points on the poles, communication equipment zones on the poles, and the worker safety zones (assuming that each have been properly installed to meet NESC requirements).

Future Problems

Many of the poles in service today were placed before CATV was expected. Because of competition in the communication industry, many telephone companies that were going underground are now adding cables overhead to compete with newly available alternative communication providers on an immediate first-cost basis, rather than full, long-term costs.

Many telephone and CATV providers each have more than one cable on the poles. The result for the foreseeable future is that space that might previously have been available for one utility will be taken by another utility on a first-come, first-